

### **REMARKS**

Applicant appreciates the Examiner's thorough consideration provided in the present application. Claims 1-10 are currently pending in the instant application. Claims 1-9 have been amended. Claims 1, 7 and 10 are independent. Claim 10 has been added. Applicant submits that claim 10 is fully supported by the original written description, including but not limited to FIG. 2 and original claim 1. Reconsideration of the present application is earnestly solicited.

### **Allowable Subject Matter**

Applicant appreciates the Examiner's indication of allowable subject matter. Specifically, the subject matter of claim 7 has been indicated as being allowable if rewritten in independent format and to address the informalities cited by the Examiner. In light of the foregoing amendments to claim 7, Applicant submits that this claim 7 should be allowed. In addition, as discussed in greater detail hereinafter, Applicant submits that the remaining claims should also be allowed and the present application should be passed to Issue.

### **Priority**

Applicant appreciates the Examiner's acknowledgment of the receipt of the corresponding certified copy of the priority document.

### **Drawings**

The drawings have been objected to due to the presence of alleged minor informalities. These objections are traversed. Applicant has filed formal drawings concurrently herewith that address the Examiner's requested changes. Accordingly, this objection has been obviated and/or rendered moot.

With respect to the features of claim 6, Applicant submits that a loop pipe (element 21 in the specification and in FIG. 2), as would be appreciated by one of ordinary skill in the art, is properly shown in the drawings. Accordingly, no drawing change is required with respect to this issue.

*Not shown  
as a loop*

### **Claim Rejections Under 35 U.S.C. § 112**

Claims 1-3 and 5-9 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. These rejections are traversed.

In light of the foregoing amendments to the claims, Applicant respectfully submits that these rejections have been obviated and/or rendered moot. However, Applicant respectfully submits that the foregoing amendments have

been made to merely clarify the claimed invention for the benefit of the Examiner.

Without conceding the propriety of the Examiner's rejection, but merely to timely advance the prosecution of the application, Applicant has incorporated the changes recommended by the Examiner. Applicant submits that the requested changes do not appear to either raise a substantial question of the patentability of the claimed invention nor do they narrow the scope of the claimed invention.

### **Claim Rejections Under 35 U.S.C. § 103**

Claims 1, 5, 6, 8 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Matsuzaka (Japanese Patent Document No. JP 3-96693) in view of Altstadt et al (U.S. Patent No. 6,289,776). Claims 2 and 3 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Matsuzaka in view of Altstadt et al., and further in view of Ellis (U.S. Patent No. 4,544,334). This rejection is respectfully traversed.

In light of the foregoing amendments to the claims, Applicant respectfully submits that these rejections have been obviated and/or rendered moot. Applicant respectfully submits that the prior art of record fails to teach or suggest each and every limitation of the unique combination of limitations of the claimed invention. Accordingly, this rejection should be withdrawn.

For example, with respect to claim 1, Applicant submits that the prior art of record fails to teach or suggest the limitation(s) of "*a structure for reducing noise and vibration in a scroll compressor, comprising an outer casing operatively connected with a suction pipe and discharge pipe; an inner casing engaged with the an inner circumferential surface of the outer casing; a driving motor engaged with the inner circumferential surface of the inner casing, for generating a rotational force; a driving shaft engaged with a rotor for transmitting the rotational force; a fixed scroll forming a discharge port, and arranged with an orbiting scroll so as to have a plurality of compression pockets, said orbiting scroll eccentrically engaged with the driving shaft, wherein said compression pockets continually move during an orbital motion of said orbiting scroll; a frame affixed on the inner circumferential surface of the inner casing, for supporting the driving shaft; and an elastic support device for elastically supporting ends of the outer casing and the inner casing.*" (emphasis added)

Accordingly, this rejection should be withdrawn.

The Examiner acknowledges that Matsuzaka is clearly not directed toward a scroll compressor. Although the Examiner opines that scroll compressors are functionally equivalent to rotary compressors, this opinion is respectfully traversed. Accordingly, Applicant respectfully requests that the Examiner support this allegation with actual evidence in the official record. Further, the claimed invention is particularly aimed at overcoming vibration

Does not address motivation to combine

and noise associated with scroll compressors, e.g., as describe in Applicant's description of the problems associated with the background art in pages 1-3 of the present application. Applicant submits that it is clear that structure of the scroll compressor is claimed in relation to the noise attenuation structure since the claimed invention is directed toward problems associated with noise and vibration in scroll compressors.

The Examiner's allegation that scroll compressors are more efficient than rotary compressors is unrelated to the claimed invention and/or any identified problem associated with Matsuzaka and/or Altstadt et al. Further, this allegation is not supported by actual evidence in the official record and is respectfully traversed. Accordingly, absent the benefit of Applicant's own disclosure, the Examiner has not identified any reason in the prior art of record as to why one of ordinary skill in the art would modify the rotary compressor of Matsuzaka to be a scroll compressor. However, the Examiner is further alleging that the rotary compressor should be modified to be a scroll compressor, but only so far as to still read on the claimed invention. This rejection is clearly improper.

Applicant respectfully submits that the Examiner has not established a reason why one of ordinary skill in the art would modify the structure of Matsuzaka compressor to be a scroll compressor, but still retain the features of the elastic supporting means, etc. Applicant submits that the Examiner has

merely attempted to identify that the Matsuzaka device could be modified, but has not identified any reason as to why one of ordinary skill in the art would attempt to do so without the benefit of Applicant's own disclosure. Accordingly, this rejection should be withdrawn.

In accordance with the above discussion of the patents relied upon by the Examiner, Applicant respectfully submits that these documents, either in combination together or standing alone, fail to teach or suggest the invention as is set forth by the claims of the instant application.

As to the dependent claims, Applicant respectfully submits that these claims are allowable due to their dependence upon an allowable independent claim, as well as for additional limitations provided by these claims.

### **CONCLUSION**

Since the remaining patents cited by the Examiner have not been utilized to reject the claims, but rather to merely show the state-of-the-art, no further comments are necessary with respect thereto.

All the stated grounds of rejection have been properly traversed and/or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently pending rejections and that they be withdrawn.

Docket No. 0630-1393P  
Appl. No.: 10/034,377  
Art Unit: 3746

It is believed that a full and complete response has been made to the Office Action, and that as such, the Examiner is respectfully requested to send the application to Issue.

In the event there are any matters remaining in this application, the Examiner is invited to contact Matthew T. Shanley, Registration No. 47,074 at (703) 205-8000 in the Washington, D.C. area.

Applicant respectfully petitions under the provisions of 37 C.F.R. § 1.136(a) and § 1.17 for a one-month extension of time in which to respond to the Examiner's Office Action. The Extension of Time Fee in the amount of **\$110.00** is attached hereto.

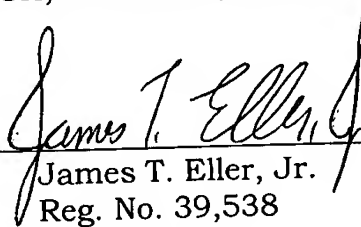
Docket No. 0630-1393P  
Appl. No.: 10/034,377  
Art Unit: 3746

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By



James T. Eller, Jr.

Reg. No. 39,538

P. O. Box 747

Falls Church, VA 22040-0747

(703) 205-8000

  
JTE/MTS/cl/mlr

Attachment(s):   Substitute Specification  
                          Drawing(s)  
                          Abstract of the Disclosure





## STRUCTURE FOR REDUCING NOISE AND VIBRATION OF SCROLL COMPRESSOR

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The ~~pre-sent~~ present invention relates to a structure for reducing noise and vibration of in a scroll compressor, and more particularly to a suction head of a structure for reducing noise and vibration of in a scroll compressor capable of reducing noise and vibration generated ~~in~~ when driving a the compressor, by ~~separated~~ separately assembling a vibration unit and ~~compressing~~ a compression unit from a casing.

#### 2. Description of the Background Art

**[0002]** Generally, a compressor changes mechanical energy into latent energy of a compressive fluid and conventionally is classified into a reciprocating-type, scroll-type, centrifugal-type and vane-type compressors.

Among these compressors, the scroll-type compressor ~~sucks/compresses/discharges~~ draws in, compresses and discharges gas using a rotary element, e.g., as in the centrifugal-type or vane-type ~~unlike~~

Marked-up copy of sub-spec.

compressors. In contrast, the reciprocating-type which compressor uses a linear reciprocating movement of a piston.

~~Figure 1 is a longitudinal sectional view showing an example of a conventional scroll compressor.~~

[0003] FIG. 1 is a longitudinal sectional view showing an example of a conventional scroll compressor of the background art. The conventional scroll compressor includes a casing 1 filled with oil to a certain height; a main frame 2 and sub frame 3 which are fixed at upper and lower sides of the inner circumferential surface of the casing 1; a driving motor which is positioned between the main frame 2 and sub frame 3, ~~being composed of~~ and having a stator 4A and rotor 4B; a driving shaft 5 pressed at the center portion of the rotor 4B of the driving motor 4, for transmitting a driving force generated in the driving motor 4 and penetrating the main frame 2; an orbiting scroll 6 placed on the upper surface of the main frame 2 and combined ~~to~~ with the driving shaft 5; a fixed scroll 7 combined ~~to~~ with the orbiting scroll 6 and fixed on the upper surface of the main frame 2 to form a plurality of compression pockets; a high/low pressure separation plate 8 combined ~~on~~ with the rear surface of the fixed scroll 7, for dividing the inner portion of the main frame 2 into a suction pressure area and a discharge pressure area; and a non-return valve assembly 9 combined ~~on~~ with the rear surface of the fixed scroll 7, for preventing a reverse flow of discharged refrigerant gas.

[0004] The casing 1 has a suction pipe (SP) at one side and a discharge pipe (DP) at the other side centering around the high/low pressure separation

plate 8. Accordingly, the suction pipe (SP) is connected to a suction pressure area and the discharge pipe (DP) is connected to a discharge pressure area. The main frame 2 and the sub frame 3 are all fixed on the inner circumferential surface of the casing 1 by the method of welding and the like and the fixed scroll 7 is ~~fixed-combined~~ secured on the lower surface of the high/low pressure separation plate 8.

**[0005]** Wraps 6A and 7A are formed on the corresponding surfaces of the orbiting scroll 6 and fixed scroll 7; The wraps 6A and 7A meshed mesh with each other being and continuously moved, which move to form an involute curve ~~to form and~~ a plurality of compression pockets are formed.

In the drawings, undescribed reference numeral 7b designates a suction port, 7c designates a discharge port and O designates an oil feeder.

**[0006]** Hereinafter, the operation of the conventional scroll compressor with the above construction will be described as follows.

First, when a power is applied to the stator 4A of the driving motor 4, the rotor 4B rotates with the driving shaft 5 at the inner side of the stator 4A and the orbiting scroll 6 orbits ~~as long as~~ over an eccentric distance. At the same time, a wrap 6a of the orbiting scroll 6 forms a plurality of compression pockets between itself and the wrap 7a of the fixed scroll 7 and the compression pocket moves to the center side of the scrolls by the continuous orbiting movement of the orbiting scroll 6. The compression pocket ~~sucks/compresses/discharges~~ draws in, compresses and discharges refrigerant gas as the volume of the pocket is reduced.

**[0007]** However, in the conventional scroll compressor, the driving shaft 5

for transmitting a power of the vibration unit to a compressing unit is combined ~~to~~ with the main frame 2 and sub frame 3 and vibration of the ~~compressing~~ compression unit is transmitted to the exterior of the casing 1 and, Accordingly, noise and vibration are generated as the main frame 2 and the sub frame 3 are abutted ~~-combined on~~ with or in contact with the casing 1.

**[0008]** Also, a portion of the casing 1 forms a discharge chamber together with the high/low pressure separation plate 8 ~~but~~, However, in this case, the refrigerant gas with high pressure is ~~collided~~ collides with the casing 1 and increases vibration and noise. Since ~~Also~~, the discharge pipe (DP) is directly connected to the discharge chamber, e.g., composed of the casing 1 and high/low pressure separation plate 8 ~~and accordingly~~, vibration and noise ~~by~~ caused by the high pressure discharge gas ~~with high pressure can not~~ cannot be reduced.

### **SUMMARY OF THE INVENTION**

**[0009]** Therefore, the present invention provides a structure for reducing noise and vibration of a scroll compressor with low noise and vibration by reducing vibration of a compressing unit and vibration unit transmitted to an exterior of a casing.

**[0010]** To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a structure for reducing noise and vibration of a scroll compressor including an outer casing connected-combined with a suction pipe and discharge pipe respectively, an inner casing combined with the inner

circumferential surface of the outer casing, a driving motor combined with the inner circumferential surface of the inner casing, for generating a rotation force, a driving shaft combined with a rotor for transmitting the rotation force, a fixed scroll for forming a plurality of compression pockets which continuously move, combined with an orbiting scroll orbiting eccentrically combined with the driving shaft and the orbiting scroll and forming a discharge port, a frame fixed-combined on the inner circumferential surface of the inner casing, for supporting the driving shaft and an elastic supporting means for elastically supporting both ends of the outer casing and inner casing.

**[0011]** The foregoing and other, features, aspects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0012]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

~~In the drawings:~~

**Figure[0013]** FIG. 1 is a longitudinal sectional view showing an example of a conventional scroll compressor;

~~Figure 2 is a~~**[0014]** FIGs. 2(A) and 2(B) are longitudinal sectional view views showing an example of a structure for reducing noise and vibration of a scroll compressor in accordance with the present invention; and

**Figure[0015]** FIG. 3 is a modified example and main portion of the structure for reducing noise and vibration of the scroll compressor in accordance with the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0016]** Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Reference numeral numerals, which are the same as the ~~conventional art~~ designates afore-mentioned background art, designate the same reference numeral and the a duplicate description will be omitted hereinafter.

**[0017]**-

The scroll compressor in accordance with the present invention includes an outer casing 11 connected to a suction pipe (SP) and discharge pipe (DP) and filled with oil to a certain height; an inner casing 12 elastically supported in the outer casing 11; a main frame 13 and sub frame 14 which are fixed at upper and lower sides of the inner circumferential surface of the inner casing 12; a driving motor 15 which is positioned between the main frame 13 and sub frame 14, being composed of a stator 15A and rotor 15B; a driving shaft 16 pressed at the center portion of the rotor 15B of the driving motor 15, for transmitting a driving force generated in the driving motor 15, and penetrating the main frame 13; an orbiting scroll 17 placed on the upper surface of the main frame 13 combined to with the driving shaft 16; a fixed scroll 18 combined to with the orbiting scroll 17 and fixed on the upper surface

of the main frame 13 to form a plurality of compression pockets; a non-return valve assembly 19 combined to accommodate the discharge port 18c of the fixed scroll 18, for preventing a reverse flow of the compressed refrigerant gas; a discharge plenum 20 combined on the rear surface of the fixed scroll 18 to accommodate the non-return valve assembly 19; and a loop pipe 21 having an end connected to the discharge plenum 20 and the other end connected to the discharge pipe of the outer casing 11.

**[0018]** At least ~~3~~ three outer supporting protrusion portions 11a are formed having a same height on the inner circumferential surface and at least inner supporting protrusion portions 12a are formed at ~~the~~ a position on a perpendicular line opposed to the outer supporting protrusion portion 11a on the outer circumferential surface of the inner casing 12.

**[0019]** Spring fixing members 23a and 23b are inserted ~~combined at~~ and engaged with the outer supporting protrusion portion 11a and the inner supporting protrusion portion 12a and an elastic member composed of the coil spring 22 for electrically supporting the inner casing 12 on the outer casing 11 is positioned on the opposed surface of the spring fixing member 23a and 23b.

**[0020]** Hereinafter, a modified embodiment of the structure for reducing noise and vibration of the scroll compressor in accordance with the present invention will be described with reference to the ~~accompanied~~ accompanying drawings.

**[0021]** First, as shown in ~~Figure~~ FIG. 3, a plurality of elastic mounting holes 12b are formed having a same height at a certain portion of the inner casing

12 and the outer supporting protrusion portions 11a are combined ~~on~~ with the inner circumferential surface of the outer casing 11 penetrating the elastic mounting holes 12b. A plurality of spring fixing members 23a are ~~combined~~ secured at a side of the outer supporting protrusion portion 11a.

**[0022]** Then, a plurality of spring fixing members 23b are ~~combined~~ attached having a same height in a certain portion of the main frame 13 and an elastic member composed of a compression coil spring for supporting the inner casing 12 on the outer casing 11 is positioned on the opposed surface between the plurality of spring fixing members 23b and spring fixing members 23a, ~~thus~~ to reduce the outer diameter of the whole compressor.

~~Also, though not described with a drawing,~~**[0023]** Although not shown in the drawings, one of skill in the art will appreciate that the inner casing 12 can be supported by hanging the upper end on the outer casing 11 or supporting the lower surface of the inner casing 12 with the bottom surface of the outer casing 11.

It is desirable that the inner casing 12 has a lower end ~~which~~ that is elastically supported having a certain height difference from the bottom surface of the outer casing 11.

**[0024]** Also, it is desirable that the lower end of the driving shaft 16 is at least formed longer than the lower end of the inner casing 12 to attenuate vibration generated when oil is sucked up with an oil feeder O.

The discharge plenum 20 can be formed by continuously connecting a plurality of discharge spaces horizontally or vertically.

**[0025]** Also, it is desirable that the loop pipe 21 is formed as a spring pipe



to set off the vibration generated in compressing and discharging and bound in various forms between the outer casing 11 and the inner casing 12 to ~~suck~~ absorb vibration by itself. More desirably, it is desirable that the loop pipe 21 is connected to the discharge pipe after being ~~bound not abutted on~~ secured without engaging the inner circumferential surface of the outer casing 11.

Undescribed reference numerals 17a and 18a are wraps of respective scrolls.

~~Hereinafter, the~~[0026]      The operation and effect of the structure for reducing noise and vibration of the scroll compressor in accordance with the present invention will be described as follows in greater hereinafter.

First, when a power is applied to the stator 15A of the driving motor 15, the orbiting scroll 6 orbits ~~as long as~~ across an eccentric distance as the rotor 15B rotates together with the driving shaft 16 at the inner side of the stator 15A. A wrap 17a of the orbiting scroll 17 forms a plurality of compression pockets which are composed of pairs between ~~itself~~ the wrap 17a and the wrap 18a of the fixed scroll 18 by performing orbiting movement at a distance of the orbiting diameter centering around the shaft center by the oldham's coupling (no reference numeral) ~~and the~~ The compression pocket moves to the center side of the scrolls by the continuous orbiting movement of the orbiting scroll 17. Accordingly, a volume of the scroll is reduced and the ~~sucked~~ refrigerant gas is ~~compressed, thus to discharging the~~ that is drawn in and compressed gas is discharged after the gas consecutively passes the discharge plenum 20, loop pipe 21 and discharge pipe (DP).

[0027]      At this time, under the condition that the orbiting scroll 17 is meshed with the fixed scroll 18, vibration is generated ~~in compressing~~ during the

compression of the refrigerant gas by the orbiting movement. However, as the main frame 13 supporting the orbiting scroll 17 and fixed scroll 18 is are fixed on the inner casing 12 and the inner casing 12 is elastically supported by the elastic member, e.g., such as the compression coil spring 22, the vibration generated ~~in~~ while compressing the refrigerant gas is prevented from being ~~sucked to~~ absorbed by the compression coil spring between the inner casing 12 and outer casing 11, and being attenuated and transmitted to the outer casing 11.

**[0028]** On the other hand, in the process ~~that~~ where the compressed refrigerant gas is discharged from the compression pocket to the discharge plenum 20, vibration by a pulsation pressure of the refrigerant gas is generated, but the vibration is attenuated at the discharge plenum 20, ~~thus to~~ reduce the whole compressor vibration.

**[0029]** Particularly, in the case of forming the discharge space of the discharge plenum 20 into many spaces, the compressed refrigerant gas passes respective discharge spaces and is attenuated, ~~thus to~~ reduce noise of the compressor ~~more~~.

Also, as the loop pipe 21 ~~which is lengthened~~ positioned between the ~~dishened-positioned between the disge pipe (DP)~~ having discharge plenum 20 and the discharge pipe (DP). The loop pipe 21 can have its own elasticity ~~is and be~~ bound on the outer diameter of the inner casing 12 or be combined by binding itself.

**[0030]** Therefore, in the structure for reducing noise and vibration of the scroll compressor in accordance with the present invention, the vibration

generated in compressing the refrigerant gas is attenuated by the elastic member between the inner casing and outer casing by fixing the compressing unit and the vibration unit on the inner casing and combining the outer casing to the outer side of the inner casing to be elastically supported.

**[0031]** As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.